REMARKS

In response to the Examiner's Action mailed on August 30, 2002, claims 1 to 20 are amended in response to the 35 USC §102(e) and 35 USC§103 rejections. The applicants hereby respectfully request that the patent application be reconsidered.

An item-by-item response to Examiner's objections or rejections is provided in the followings:

1.. *Claim Rejection – 35 USC § 112*

The Examiner rejects claims 9 and 16 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding claim 9, a "range" of pressures is claimed, but there is only one value that is given. Appropriate correction is required. Regarding claim 16, it is unclear what "low" in line 2 describes.

In response to the rejection, claims 9 and 16 are amended and the terms rang and low are deleted.

2.. *Claim Rejection – 35 USC § 102*

The Examiner rejects claims 1-6,10-12 and 15 under 35 U.S.C. 102(e) as being anticipated by Adibi et al. (5,883,391). According to the Examiner, with regard to claims 1-6, Adibi et al. teach an ion implantation apparatus tat contains a holder for a target substrate to be implanted and an ion source chamber that generates an ion beam (col. 3, lines 23-24). They teach the use of a beam deceleration means that provides a deceleration electric field that reduces the energy of the ion beam (col. 2, lines 34-39). They also teach the blocking of neutralized particles in a mass selection chamber that prevents them from reaching the target for implantation. These neutralized particles propagate and will continue to fly in the direction of the beam ion and will be absorbed in the mass selection chamber, thus blocking them from being steered towards the target chamber (col. 7, lines *50-57).* Adibi et al. teach the use of an analyzer magnet that resolves the ion beam according to mass (col. 4, lines 24-26). An

electrostatic focusing field is established by applying a potential to a cylindrical electrode (col. 7, lines *1-5)*. This field is used to steer the neutralized particles in a different direction than the targeted ion beam path as describes above. They teach that a potential is applied to the field electrode thus generating a negative electric field that decelerates the ion beam (col. 6, lines 66-67 and col. 7, lines 50-57). Regarding claims 10-12 and 15, Adibi et al. teach a beam deceleration means as stated above, and a beam steering means for separating the neutralized particles from the ion beam and propagating those particles in a direction that is different than the targeted ion beam. They also teach an ion beam collector, positioned downstream, that serves as a beam stop (col. 4, lines 38-41). They teach a means for blocking the neutralized particles from reaching the implantation target as described above.

In response to Examiner's rejections, claims 1 and 10 are amended to overcome the rejection under 35 USC §102(e). The amended claim 1 is directed to a method for performing an ion implantation comprising:

a) providing a target chamber for containing a target for implantation and an ion source chamber including an ion source for generating an ion beam;
b) disposing **adjacent to said target chamber** a beam deceleration optics that includes **means for generating an off-axis electric field for decelerating and deflecting charged particles in** said ion beam to project toward said target **along a deflected angle away from neutralized particles in said ion beam.**

The amended claim 1 is new and non-obvious over Adibi. Adibi does not have a deceleration means disposed adjacent to the target chamber to generate an off-axis electrical field for decelerating and deflecting the charged particles away from the neutralized particles in the ion beam as now explicitly added into the claim 1.

Similarly, claim 10 is also amended to direct to a method for generating an implantation ion beam from an ion source projecting a plurality of ions comprising a step of disposing a **beam deceleration means adjacent to a target wafer of implantation for decelerating and deflecting charged particles away from**

neutralized particles in said ion beam to project the decelerated and deflected charged particles to said target wafer of implantation.

Since Adibi does not have a deceleration means disposed next to the target wafer for decelerating and deflecting the charged particles away from the neutralized particles as now directed in the amended claims. The methods as now directed by the amended claims are different and not obvious over Adibi. The Applicant would like to respectfully request that the 35 USC 102 rejections for the claims be withdrawn for the amended claims.

3. Claim Rejection – 35 USC § 103

The Examiner further rejects 7-9 and 13-20 under 35 U.S.C. 103(a) as being unpatentable over Adibi et al as applied above, and further in view of Dawson et al. (6,111,260).

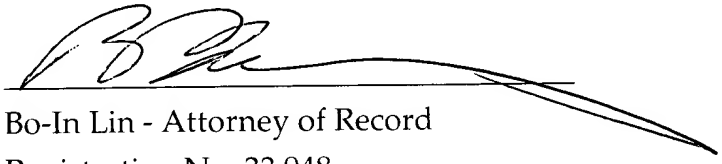
According to the Examiner, with regard to claims 7-8, 13, and 20, Adibi et al. teach an ion beam steering means as described above, but fail to teach a small, deflected angle relative to the horizontal axis. However, Dawson et al. teach steering the ion beam in the direction of the wafer target that is offset approximately 5 to 10 degrees relative to the horizontal axis for scanning thereof (col. 7, lines 4-9). In view of Dawson et al. and ordinary skill in the art, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use this beam spread for the purpose of steering the ion beam toward the target so that implantation can occur without including the neutralized particles. Regarding claim 9, the above applied prior art makes use of a cryo-pump, but does not speci~' the pressure range of the chamber or the claimed ion beam energy levels. However, the teachings read on the claimed limitation, since one skilled in the art would reasonably estimate the pressure range be such so that the desired implantation will occur as claimed. In addition, Dawson et al. teach a target chamber maintained at a pressure that is less than l0~ Ton (col. 7, lines 1-2). Dawson et al. also teach that ion energy levels from 15 - 40 keV can be controlled (col.4, lines 40-41). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a target chamber with a vacuum of 1 o~ Torr and an ion beam energy level as low as 200

eV so proper implantation will occur. Regarding claims 14 and 16-19, the prior art discloses the claimed invention except for the appropriate beam-height to beam-width ratio. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use an ion beam with the necessary height to width ratio for proper implantation, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

As explained above, in response to the rejections, claims 1 to 20 are amended. As discussed above, the amended claims direct to an ion implantation apparatus that includes an ion deceleration means that has electrodes disposed immediately before the target chamber for accelerating and deflecting the charged particles away from the neutralized particles. Such configuration and functions are not found in any of the prior art references. Therefore, the amended claims would not be obvious in view of Adibi and Dawson, since none of the prior art references either disclose of suggest such charged-particle deflection means disposed adjacent to the target chamber. Contrarily, the cited prior art as that disclosed in Dawson employs a "focus means to focus the beam" to carrying out the implantation by "scanning" using a focus beam of very small beam spot. A person of ordinary skill in the art, after reading the prior art references would not devise an apparatus directed by the amended claims now. For these reasons, the Applicants would respectfully request the obviousness rejection under 35 USC 103 be withdrawn for the amended claims.

For the amendment set forth and the reasons provided above, the Applicants would like to respectfully request that Examiner's objection and rejections be withdrawn. Furthermore, the Applicants respectfully request that the amended Application be allowed and issued as a Patent.

Respectfully submitted for Jiong Chen et al.

By 

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Version with Markings for Showing Changes Made

In the Claims:

(Amended) 1. A method for performing an ion implantation comprising:

providing a target chamber for containing a target for implantation and an ion source chamber including an ion source for generating an ion beam;

[providing] disposing adjacent to said target chamber a beam deceleration optics that includes [a beam deceleration means in said ion source chamber] means for generating an off-axis electric field for decelerating and deflecting charged particles in [decelerating] said ion beam [for producing a low energy ion beam] to project toward said target along a deflected angle away from neutralized particles in said ion beam. [;]

[providing a beam steering means to said beam deceleration optics to separate neutralized particles out of said ion beam by keeping said neutralized particles propagating in a neutralized-particle direction slightly different from a steered targeted ion-beam direction; and]

[employing said ion-beam deceleration optics for transmitting said ion beam along said targeted ion-beam direction to said target for implantation and for blocking said neutralized particles from reaching said target for implantation.]

(Amended) 2. The method of performing an ion implantation of claim 1 wherein:

[providing] disposing an analyzer magnet adjacent to said ion source chamber for mass filtering said ion beam.

(Amended) 3.The method of performing an ion implantation of claim 1 wherein:

said step of disposing said deceleration optics further comprising a step of disposing electrodes adjacent to said target chamber for generating said off-axis electrical field for decelerating and deflecting said charged particles in said ion beam.

[said step of employing said beam deceleration means further includes a step of [providing a deceleration electric-field means for generating a deceleration electric-field for decelerating said ion beam for producing a low energy ion beam] .

(Amended) 4. The method of performing an ion implantation of claim 1 [wherein] further comprising:

disposing said target on a target support and disposing said target support at an inclined angle whereby said target is perpendicular to said charged particles projected along said deflected angle.

[said step of employing said ion beam steering means for generating an electrostatic field for keeping said neutralized particle to transmit along a trajectory different than said ion beam carrying electric charges comprising a step of steering said ion beam to transmit in a targeted ion-beam direction slightly different from said neutralized-particle direction].

(Amended) 5. The method of performing an ion implantation of claim 1 [wherein] further comprising:

[said step of employing an ion-beam deceleration optics further includes a step of employing] disposing a neutralized beam blocking means between said deceleration optics and said target wafer chamber for blocking said neutralized particle from reaching said target [of implantation in said target] chamber.

(Amended) 6. The method of performing an ion implantation of claim 1 wherein:

said step of providing an ion source in an ion source chamber is a step of providing an ion source for generating a positive charged ion beam; and

said step of [employing] disposing said beam deceleration [means] optics includes [the] a step of [employing] disposing a [deceleration electric-field] means for generating a negative off-axis electric-field for decelerating and deflecting said charged particles in said ion beam. [for producing a low energy ion beam].

(Amended) 7. The method of performing an ion implantation of claim 1 wherein:

said step of generating said off-axis electrical field for decelerating and deflecting said charged particles in said ion beam is a step of deflecting said charged particles at [employing said ion beam steering means comprising a step of steering said ion beam carrying electric charges to transmit in said targeted ion-beam direction at] a small deflected angle relative to a projected direction of neutralized particles.

(Amended) 8. The method of performing an ion implantation of claim 7 wherein:

said step of [employing said ion beam steering means to steer] decelerating and deflection said charged particles in said ion beam [carrying electric charges to transmit in said targeted ion-beam direction] comprising a step of [steering] deflecting said ion beam at a small deflected angle in a range of three to fifteen degrees relative to [the horizontal axis] a projection direction of said neutralized particles.

(Amended) 9. The method of performing an ion implantation of claim 1 wherein:

said step of providing said ion source in said ion source chamber comprising a step of providing said ion source chamber and said target chamber with a vacuum [in the range of] of approximately 10^{-5} Torr; and

said step of [employing said ion beam deceleration means comprising] decelerating and deflecting said charged particles is a step of decelerating said ion beam to an energy level as low as about 200 eV with an energy contamination of less than about 0.1%.

(Amended) 10. A method for generating an implantation ion beam from an ion source projecting a plurality of ions comprising:

[employing] disposing a beam deceleration means adjacent to a target wafer of implantation for decelerating and deflecting charged particles away from neutralized particles in said ion beam to project decelerated and deflected charged particles to said target wafer of implantation. [ions projected from said ion source;]
[employing a beam steering means for generating an electrostatic field for separating a plurality of neutralized particles from said ion ions by keeping said neutralized particles propagating in a neutralized-particle direction slightly different from a targeted ion-beam direction of said ions.]

(Amended) 11. [A] The method of claim 10 further comprising:

arranging a wafer implant position with a small inclined angle relative to a projection direction of said neutralized particles corresponding to and substantially perpendicular to a projection direction of said charged particles [targeted ion-beam direction] for accepting said ions projected thereto.

(Amended) 12. The method of claim 10 further comprising:

[said step of transmitting said ions to a target of implantation further comprising a step of employing] disposing a blocking means between said decelerating means and said target wafer for blocking said neutralized particles from reaching said target of implantation.

(Amended) 13. The method of claim 10 wherein:

said step of disposing said decelerating means further comprising a step of disposing electrodes adjacent to said target for generating an off-axis electric field for decelerating and deflecting said charged particles away from neutralized particles in said ion beam. [separating said neutralized particles from said ions comprising a step of providing a charged particle deflection means for deflecting said trajectory of said ions at a small angle from said trajectory of said neutralized particles].

(Amended) 14. The method of claim 10 [further comprising] wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam [configuring said ion beam deceleration means for decelerating and processing said ions into an ion beam] having a large beam-height to beam-width ratio.

(Amended) 15.The method of claim 10 further comprising:

[providing] disposing a beam block between said deceleration means and said target wafer for blocking said neutralized particles propagating in [said] a neutralized-particle direction.

(Amended) 16. The method of claim 10 [further comprising] wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam and having [projecting said ions in forming said implantation ion beam with high beam current and low energy and] a ratio of a beam height to a beam width equal or larger than 20.

(Amended) 17. The method of claim 16 wherein:

said step of [forming said implantation ion beam] deflecting said charged particles into a high aspect-ration beam having a ratio of a beam height to a height to a beam width equal or larger than 20 comprising a step of providing an extraction aperture for said ion source with an aspect ratio equal or larger than 20.

(Amended) 18. The method of claim [10] 16 wherein:

said step of [configuring said ion beam deceleration means for decelerating and processing said ions into an ion] deflecting said charged particles into a high aspect ratio beam having a large beam-height to beam-width ratio comprising a step of [processing] deflecting said [ions] charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4.

(Amended) 19. The method of claim 18 wherein:

said step of [processing] deflecting said [ions] charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4 comprising a step of providing an aperture of [a] said beam deceleration means [and steering optics] having a beam-height to beam-width ratio equal or greater than 4.

(Amended) 20. The method of claim 13 wherein:

said step of [providing a] deflecting said charged particles away from neutralized particles [particle deflection means for deflecting said trajectory of said ions at a small angle from said trajectory of said neutralized particles] comprising a step of deflecting said charged particles to project [trajectory of said ions] at an angle in the range of three to fifteen degrees relative to a projection direction of said neutralized particles.